1,103,946

# PATENT SPECIFICATION

DRAWINGS ATTACHED

1,103,946

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Int. Cl.: —G 03 b 19/04

## COMPLETE SPECIFICATION

## Improved Film-feed Mechanism for a Photographic Camera

We, CANON CAMERA COMPANY INCORPORATED, a corporation organized under the laws of Japan, of 312 Shimomaruko-cho, Ohta-ku Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to improved film-feed mechanism for a photographic camera.

More particularly it relates to a film-feed mechanism wherein a strip of film is driven by a sprocket wheel and automatically wound on a spool by friction supplied by a set of friction-members provided thereon as the camera is loaded.

In loading conventional cameras with a fresh film supply, the front end of the film is manually either placed into, or folded and suspended in, a split formed in the spool. Such manual operation is not only tedious but the result is uncertain.

In another known device, the film-winding shaft for winding the film into the film chamber is covered with a friction-pad of rubber and at the same time pressure is provided to press the film against the film-winding shaft, thus enabling the film being fed into the film chamber to be wound around the film-winding shaft. In this arrangement, however, since the leading edge of the film must come forward under pressure, a loose section is formed at the leading end which interferes with the winding. In another similar device the film-winding shaft for feeding film into the film chamber is provided with a plurality of projections instead of friction-pads of rubber or similar material interlocking with the perforations of the film strip, again, however, resulting in similar defects, since the desired security and uninterrupted automatic interlocking is not possible because the displacements of the perforations of the film strip, as it wound are unequal.

The invention aims to provide a device for simplifying and improving the film-feed mechanism for a photographic camera.

The invention also aims to provide a device for improving the film-feed mechanism for a photographic camera, in particular a film guide plate which assures that, in loading, the position of the perforations in the film strip which engage with the complementary projections of the film-feed mechanism is maintained until the back plate of the camera has been completely closed and after which the film-feed is automatically wound on the spool as the film winding operation is continued.

The invention also aims to provide a device which prevents the curled leading edge of the film from intruding between each arm of the friction members so that the device is capable of very smooth automatic winding in layers by means of a set of friction-members provided on the spool.

The invention also aims to provide an improved film-feed mechanism, which enables more pictures to be taken than in known systems, despite the same camera size.

With these objects in view, and in accordance with the present invention, there is provided a photographic camera comprising a film-feed mechanism, a cylindrical film-winding chamber a rotatable shaft

carrying a spool and coaxially arranged in the chamber and in driving engagement with the film-feed mechanism, the spool being provided with a plurality of movable arms each of which is spring urged radially outwards so that the film, as it is wound into the chamber is maintained tight against the walls of the chamber.

Preferred forms of the invention will now be described, by way of example, with reference to the accompanying drawings.

Figure 1 is a cross sectional view of a camera provided with an illustrative embodiment of the invention,

Figure 2 is a sectional view of the more important parts of the camera of Figure 1 in which a substantial amount of film has been wound up,

Figure 3 is an enlarged sectional view of part of the camera illustrated in Figure 1,

Figure 4 is a cross sectional view of a camera provided with another illustrative embodiment of the invention,

Figure 5 is a side sectional view of the camera illustrated in Figure 4,

Figure 6 is a top sectional view of part of the camera shown in Figure 4,

Figure 7 is a cross sectional view of that section of the camera provided with another illustrative embodiment of the invention as it lies when the back plate of the camera is completely closed,

Figures 8 to 11 are sectional views of the invention as seen in Figure 7 showing the sequence of the positions taken up by the various components during the opening of the back plate of the camera body,

Figure 12 is a top plan view of the invention in that stage illustrated in Figure 9,

Figure 13 is a plan view of the operatively participant part of the camera body as it lies in the stage of operation illustrated in Figure 11,

Figure 14 is a cross sectional view of a camera provided with another illustrative embodiment of the invention with the back plate of the camera body completely closed,

Figure 15 is a sectional view of the camera shown in Figure 14 showing the sequence of operations in opening the camera back,

Figure 16 is a side sectional view of part of the camera shown in Figure 14 when the back plate of the camera is half opened as illustrated at $307_2$,

Figure 17 is a side sectional plan view of a part of a camera illustrating another embodiment of the invention with the back plate of the camera fully closed,

Figure 18 is a development on an enlarged scale of a part of the apparatus as it is illustrated in Figure 17,

Figure 19 is a top view of the part of the apparatus shown in Figure 18,

Figure 20 is a perspective view of a top end of a film supply as this is inserted, for the purpose of illustrating the operational movement of the form of embodiment of the invention illustrated in Figures 17—19, and

Figure 21 is an exploded view of a modified form of embodiment of the invention.

In the camera 1 illustrated in Figures 1 and 2, a film F is led from a spool 2 and is fed by a film-feed mechanism such as a sprocket wheel 4 or a roller into a cylindrical film-winding chamber 5 and is wound into a roll along the wall surface of the film chamber 5. When the number of layers has reached a certain value, friction exerted between the layers prevents the inner diameter of the layers from being further reduced in size resulting in the prevention of the remainder of the film being fed.

In order to avoid this defect in accordance with one embodiment of the invention, a rotatable spool is provided in the film-winding chamber 5 which has friction-members 6 to assist the forward movement of the front end $F_1$ of the film F, and at the same time automatically reduce their swept diameter, i.e. the distance from the vertical axis of the spool, as the number of wound on coils of film increases. The spool comprises a shaft 7 which is in driving engagement with a film winding mechanism and also with the film feed mechanism 4. The shaft 7 is carried on the upper and lower surfaces of the film-winding chamber 5 and provided with flanges 8 which have arcuate supporting arms 10 pivoted on pins 9, the supporting arms 10 having on their outer surface friction-elements 11 pressing radially against the inner side of the film. Springs 12 which bias the arms outwardly are arranged to lie between the supporting arms 10 and studs 13, which at the same time serve as limiting stops for their adjacent supporting arms. In a preferred form there are several friction-members 6 equally spaced around a circle, with each member pivoted on a pin 9 at a point angularly spaced by an angle $\alpha$ ahead, in the direction of rotation of the shaft 7, of the point $a$ at which the film surface makes contact with the friction-member, so that the inner diameter of the coil of wound film may readily be reduced, as the amount of wound film increases. The arms 10 are inclined in a direction opposite to the direction of rotation of the shaft 7. The friction-members are preferably in the form of fins, or radial projections, able to reduce their swept diameter by being pivoted in the direction opposite to the direction of rotation of the shaft 7. When the film F is fed into the film-winding chamber 5 by the film-feed mechanism 4 as illustrated in Figure 1, the front end $F_1$ thereof is held between the wall of the chamber and one of the friction-members 6 which are rotated in driving engagement with the film-feed mechanism. The rotating friction-members 6 press the film with a suitable pressure

against the wall surface of the film-winding chamber to introduce it into the said chamber and simultaneously reduce their radius of operation against the springs 12 accordingly as the number of layers or coils of wound film increases. In this form of embodiment of the invention, coils of wound film are formed inside the film chamber from outside, the leading edge of the film gaining smooth entrance and forward movement into the chamber, and the operating radius of the friction-members being reduced so that the film being fed is wound more tightly and is of greater amount, and thus at the same time, an easy loading operation is effected without difficulty. It is additionally noted that the slipping movement between layers of the film may occur in a suitable amount and frequency to assure suitable operation, since each friction-member is arcuate and axially held at a point spaced angularly in front of the contact point with the film surface so that it naturally sinks inwardly as the inner diameter of the coil of film decreases as the number of turns of film in the coil increases.

In another form of embodiment of the invention illustrated in Figures 4, 5 and 6, different from that illustrated in the preceding Figures, each friction-member 103 has its contact point with the film F selected at a point angularly spaced by an angle $\alpha$ before its supporting stud 104. The arms $103_1$ are inclined in a direction which is the same as the direction of rotation of the shaft. It is evident from the side sectional view of Figure 5, that the free end of the supporting arm $103_1$ of the friction member 103 is extended to lie between the pivots of the supporting arm $103_2$ of the preceding friction-member 103. Similar adjacent friction-members are arranged with suitable clearances so that they do not in any way interfere with each other as they pivot about their studs 104. As the coil of layers of the film increases in size, each friction-member 103 sinks deeper towards the centre against the biassing action of the spring 105, the body of friction-member 103 together with its part $103_1$ approaches, and finally enters the cut-out part between parts $103_2$ and $103_3$ (Figures 5 and 6). The body of each friction-member 103 is made of such material as metal, or hard synthetic resin, to which is glued a friction-element $103_3$ of rubber or soft synthetic resin, and which faces the film strip. Referring to Figures 5 and 6, the camera body is designated as 106, the back plate as 107, the film-feed mechanism as 108 and portions of a film guide plate for smoothly introducing the film supply into the film-winding chamber as 109 and 110. Referring to Figures 4 and 6, when the spool 102 and the friction-members 103 are rotated, interlocking with the film-winding shaft for winding the film in the direction indicated by arrows, the film strip F fed in by the film-feed mechanism 108 which is also in driving engagement with the film winding mechanism or any other suitable feeding roller comes in contact with the friction-element $103_3$, which in turn rotates, pressing the film F against the internal wall of the film-winding chamber 101. Since the stud 104 lies behind the point of contact of the element 103, in the direction of rotation of the spool 102, the force extended by the friction-member 103 increases as the resistance to the movement of the film increases thus the force for feeding the film by friction and that for tightly winding it along the wall of the film chamber are effectively increased. Furthermore, since serially preceding and following friction-members 103 have the free ends of their supporting arms $103_1$ protruding into the cut-out parts between the parts $103_2$ and $103_3$ (Fig. 5) the possibility that the front end of the film might curl up in the interspace between spool 102 and friction-members 103 is eliminated.

Referring to Figure 7 to 13 which illustrate another embodiment of the invention, the camera body is designated as 201, having a back plate 202 provided with a hinge 203 for opening and closing, a film-feed mechanism 204 which is in driving engagement with the film wind mechanism a film guide plate 205 and a cylindrical film-winding chamber 206 which is an extension of the film guide plate 205. A spool 207 having several radial friction-members 208 is arranged in the film-winding chamber 206.

The spool 207 is rotated by a bearing which is interlocked with the film-winding mechanism, pressure being applied by the friction-elements 209 to the film against the internal wall of the film-winding chamber 206, the friction-elements being of such material as foamed latex or synthetic resin. The friction members 208 are designed to pivot against springs 211, around pins 210, as the wound coils of film increase. It is necessary in the embodiments shown in Figures 1—6 to keep the back plate of the camera open after the film has been forwarded into the winding chamber 206, until held by one of the friction-members 208.

However, with the embodiment of the invention illustrated in Figures 7 to 13, the loading of the film supply is completed when the film F is placed on the film-feed mechanism 204 after the back plate 202 has been opened, and then re-closed. In this embodiment, a portion of the film-winding chamber 206 has an extended guide $206_1$ which is connected to chamber 206 by the pin 212. The guide $206_1$ extends as far as the film-feed mechanism 204 to form a film guide plate $206_2$. As the back plate 202 is closed, the film guide plate $206_2$, interlocked therewith, presses the film F against the guide plate 205, prior to the complete closure of the back

plate. It is to be preferred that rollers 213 rather than projections should be provided on the plate $206_2$ for pressing the film across the film guide plate 205. The interlocked action of the film guide plate $206_2$ and the back plate 202 is preferably produced by a suitable linkage. In the illustrated form of this embodiment of the invention, use is made of arm 216 which is interlocked with the back plate 202 by means of a slot 214 and a pin 215. An arm 218 is interlocked with the film guide plate $206_2$ by means of a pin 217 and is connected to the arm 216 by a pin 219. Figures 10 and 11, show the camera with the back plate 202 completely opened. The arms 216 and 218 are extended in a line, the film guide plate $206_2$ and the film guide $206_1$ are raised together around the pin 212 against a leaf spring 220, and the film guide plate 205 and a part of the film-winding chamber 206 are exposed. The film F is then placed on the film guide plate 205 and the film-feed mechanism, and then pulled out so that its front edge reaches the winding chamber 206. The back plate 202 is then closed. When it is raised substantially by 90°, to the position shown in Figure 9, the film guide plate $206_2$, together with the rollers 213, press the film on to the guide plate 205 and the loading of the film is practically completed. The only remaining operation is the folding of the arms 216 and 218 by further closing of the back plate 202. The opening of the back plate results in the reverse of the operation sequence described above. In the form of this embodiment, the back plate 202 is opened through an angle of 180°.

Referring now to Figures 14 to 16 which illustrate another embodiment of the invention. The camera body is designated as 301, the film-feed mechanism as 302, section which make up a cylindrical film-winding chamber and film guide plates, are designated as 303*a* and 303*b* respectively, the former being firmly fixed to the camera body 301 and the latter hinged to 303*a* at pin 304. There is an opening which serves as the film passage 305 between sections 303*a* and 303*b*. At the position in the forward direction, that is the film feeding direction, of passage 305 there is provided an extension, film pressing element 303b', which is either integral with the film guide plate 303*b* or communicatively affixed to this, the said film pressing element having rollers 306*a* and 306*b*, one on each side of film-feed mechanism 302, for pressing on the film. A back plate 307 is hinged to the camera body 301 at pin 308, the back plate 307 being engaged with the film guide plate 303*b*, as described below. A slot-shaped guide 309 is formed on the back face of the guide plate 303*b* in which a movable slide 310 is secured and which in turn is connected to the back plate 307 by means of a leaf spring 311. The leaf spring 311 is connected to the back-plate 307 by a hinge 312. A stop 313 determines the position of the film pressing element 303*b'*, together with a pressure plate 314. A film-winding spool 315 is provided with rising and sinking friction-members 317 with the friction-elements 316 for pressing the film against the film guide 303*a* and winding it. Referring now to Figure 16, the film guide plate 303*b* is hinged at one end by a pin 304 and effects pressure on the film together with the element 303*b'* which is fixed to 303*b* by screws. The film guide plate 303*b* has at its central portion a channel-like cover forming a space S between the cover and element 303*b'*. Both front ridges of the slide 310, which is secured to the front end of the leaf spring 311, can slide within the space S. The element 303*b'* has guides 309, which in association with the pins 310' provided on the slide 310 and projected into the housing, guides the sliding movement of the slide 310. As explained hereinafter, the leaf spring 311 is connected to the back plate 307, and consequently, the slide 310 fixed to the leaf spring 311 is able to slide to right and left in the drawing of Figure 16 during the opening and closing operation, respectively, of the back plate 307. When the back plate 307 is being opened, the slide 310 moves to the right until the pins 310' projected from the slide 310 engage with the rear end side $309_1$ of element 303*b'*. Further opening of the back plate 307 urges the film guide plate 303*b* and the element 303*b* to pivot up about the hinge 304 with the aid of the leaf spring 311.

In this embodiment, the back plate 307 is opened by some 180° along the dotted line $307_1$ as illustrated in Figure 15. During the course of substantially the first 90° of the opening operation the slide 310 moves along the guide 309. Whilst the back plate 307 is being opened the remaining 90° the slide 310 which is connected to the leaf spring 311 is engaged with the rear end $309_1$ of the guide 309, thus raising the film guide covers 303*b* and 303*b'* by approximately 90° as far as the position of $303b_1$. At this stage of opening, the film is loaded. The front end portion of the film is so placed as to have its perforations engaged with the film-feed mechanism 302, and when the back plate 307 is closed by approximately 90° through stages $307_1$—$307_2$—307, as illustrated in Figure 15, the film guide cover 303*b*, 303*b'* is made to sink by tension from the leaf spring 311 until it contacts the film pressing it on to film feed mechanism 302. Thus the film strip need not be handled. When the back plate 307 is closed by a further 90°, the leaf spring 311 is returned to its original position with the slide 310, proceeding along the guide 309, so that the back plate 307 is folded as illustrated in Figure 14.

With the embodiment of the invention

as illustrated in Figures 14 to 16, the back plate and the guide cover are connected or linked by means of a spring and when the film supply is to be unloaded, the operation is carried out in conjunction with the opening of the back plate, the film being released when the back has been opened to approximately halfway. In loading the film the operation is reversed, namely, that when the back plate, has moved through the first 90° the film guide plate is closed, and in the latter 90° of the closing operation, the interlocking spring is forwarded along guide 309 to be included within guide 309'. Generally such an interlocking mechanism as may be seen in the form of embodiment of the invention illustrated in Figures 7 to 13 is worked by the combination of several links. However, the space available for loading the film is limited so that great effort is required for building in such a link assembly which often lacks smooth operation. With the form of embodiment of the invention shown in Figures 14 and 15, the installation of the mechanism is simplified by utilising the narrow space between the back plate and the camera body and it is also structurally simplified since it requires no more than a single leaf spring for interlocking.

With the embodiments of the invention illustrated in Figures 7 to 13 and Figures 14 to 16 the closing of the back plate completes the film loading, the film being brought forward into the film-winding chamber and prevented from springing off by the use of pressure, without its being necessary to close the back plate of the camera body completely, with the result that the loading of the film is considerably simplified and rapidly completed.

Another form of embodiment of the invention is illustrated in Figures 17 to 20. The film, is wound via a film-feed mechanism 402 into a cylindrical film-winding chamber $403_1$ and $403_2$, from the outer to the inner sides in coils along the internal wall of the chamber in the camera body 401. In the film winding chamber is provided the film spool 405, having friction-members 404 mounted on arms 409 which direct the forward movement of the leading end of the film and, in relation to the increase in the number of film coils, the outer diameter of their circular movement is diminished as they press the coils outwardly. The interlocking action of the back plate 420 and the film guide cover $403_2$ is as described in the embodiment of Figures 14—16. The guide cover $403_2$ is provided with a guide slot 419 in which a slide connected to a leaf spring 421 can freely move. The cover $403_2$ is hinged to the fixed part of the film winding chamber $403_1$ at 417. Movement of the back plate 420 to the position $420_1$ causes the slide to move along the slot 419 until it reaches a stop 422. Further movement of the back plate 420 to the position $420_2$ lifts the guide cover to the position shown in dashed lines in Figure 17. Rollers 418 carried by brackets attached to the guide cover $403_2$ serve to press the film, when it is loaded into the camera, across the film feed mechanism 402. In this form of embodiment, the winding of the film takes place automatically and positively with the help of the forward movement energy of the film as this is fed by the film-feed mechanism, and there can be no possibility of faulty film loading so long as the film strip is engaged in the sprockets of the film-feed mechanism 402. However the film strip is generally provided with a film leader $F_1$, as illustrated in Figure 19, with the top corners cut away as $F_3$, $F_4$. In order that the internal diameter of the coil of wound film can decrease as the amount of wound-on film increases, it is necessary that each layer of the film is continually moved relative to the layers above and below it. Thus the leading edge of the film is continually moved relative to the next wound on layer and there is a danger that the corner $F_3$ might catch in the sprocket perforations of this next layer and thus prevent this relative movement and possibly damaging the film. In order to prevent this possibility, means are provided for disaligning the corner angle $F_3$ from the line of perforations on the film strip when the winding of the film by friction-members 404 is proceeding namely by moving the leading edge of the film to one side. Referring to Figures 17—19, an opening 406 is provided in the wall of the film winding chamber $403_1$ in a position which lies out of the path of the friction-members 404 as illustrated in Figure 19, the said opening lying, however, in the path of the advancing corner $F_4$ of the film. A projection 408 supported on a spring 407, extends through the opening 406 so as to extend into the film-winding chamber and press the corner $F_4$ of the leading end of the film to one side to prevent the corner $F_3$ from being aligned with the film perforations P. By such construction, any dissatisfactory operation such as previously mentioned, is avoided despite increase in the number of coils of the film fed into the chamber 403, since the leading edge of the film retains its initial displaced position due to the pressure of the friction pads 404. Also, it is to be noted that no trouble can occur since the projection 408 is continuously pressed out of the film-winding chamber against the urging of the spring 407, to an increasing extent, as the coils of film increase in number.

Referring to Figure 21, which illustrates another embodiment of a film spool which includes means for displacing the corner of the leading edge of the film from alignment with the line of film perforations by pressure against the leading end of the film; a rotat-

able spool 405 to be rotated by a rotor 416 by means of a gear B fixed thereon which is in driving engagement with the film winding shaft (not shown) is provided with a raisable set of supporting arms 409, rotatably mounted on respective shafts 415 affixed to the rotor 416 and a cam disc 412, each arm being provided with a friction member 404 continuously urged upwards by a spring 410 and which, press the fed film against the internal wall of the film-winding chamber against the pressure of the spring 410 the arms pivoting about their shafts 416 as the number of coils of film in the film-winding chamber increases. In this embodiment one end of the rotatable spool 405 is provided rigidly with the cam disc 412 supporting as many cams 411 as there are supporting arms 409, each of the latter being provided with a projection 413, and being urged by a plate spring 414 which are secured to the rotor 416 to continuously engage the projections 413 with their corresponding cams 411. Consequently, as the supporting arms 409 are depressed in sequence as the fed film is wound, each projection 413 moves to the higher portion of each cam 411 thus moving the supporting arms 409 and the friction members 404 to the right as shown in Figure 21 against the force of the springs 414. Thus, each friction member 404 moves in the direction of the composite vector V, pressing the film in the direction of vector V and achieves its purpose in misaligning the corner $F_3$ and the film perforations. A tongue portion A of each supporting arm 409 prevents the leading end of the film from curling into the space between the successive arms 409.

As an alternative construction, the shaft 415 about which the supporting arms 409 pivot may be designed to rotate integrally with the supporting arms 409; the shaft 415 being threaded to engage in threaded holes provided in the disc 412 which in this embodiment carries no cams and the rotor 416. The shafts 415 and the supporting arms 409 thus move to the right or left guided by the threads, as the supporting arms 409 are depressed or raised. Thus, each friction member 404 moves in the composite direction V, pressing the film in the direction of the Vector V as the supporting arms 409 are depressed in sequence.

The type of spool shown in Figures 17—21 can of course be used with a camera having a back which closes as shown in any of the described embodiments.

WHAT WE CLAIM IS:—

1. A photographic camera comprising a film-feed mechanism, a cylindrical film-winding chamber, a rotatable shaft carrying a spool and coaxially arranged in the chamber and in driving engagement with the film-feed mechanism, the spool being provided with a plurality of movable arms each of which is spring urged radially outwards so that the film, as it is wound into the chamber, is maintained tight against the walls of the chamber.

2. A camera as claimed in claim 1 wherein each arm is fitted with a friction element for engagement with the film.

3. A camera as claimed in either of the preceding claims wherein each arm is inclined in a direction opposite to the direction of rotation of the shaft.

4. A camera as claimed in claim 1 or claim 2 wherein each arm is inclined in a direction which is the same as the direction of rotation of the shaft.

5. A camera as claimed in any preceding claim wherein each arm carries an extension and the extension of each arm extending towards the adjacent arm so as to prevent the leading end of the film feed into the chamber from being curled into the space between the shaft and the friction element.

6. A camera as claimed in any preceding claim and including a back plate hinged to the camera body adjacent to the film-winding chamber, a film guide plate hinged to the chamber at the side of the hinge at the back of the plate and extending to a position near a sprocket constituting part of the film-feed mechanism, the guide plate being connected with the back plate in such a way that until the back plate has been opened by substantially 90° there is no engagement between the guide plate and back plate, but when the back plate is opened by more than 90° the guide plate is moved with the back plate.

7. A camera as claimed in claim 6 wherein the engagement between the guide plate and the back plate comprises a leaf spring mounted on the back plate.

8. A camera as claimed in claim 6 wherein the engagement between the guide plate and the back plate comprises a link mechanism.

9. A camera as claimed in any preceding claim, wherein the arms are mounted on the spool in such a way that they may move in the axial direction of the spool as they move radially inwardly or outwardly, so that the leading edge of the film is prevented from catching in the following perforations in the film.

10. A camera as claimed in any preceding claim wherein the film-chamber is provided with an internal projection serving to guide the leading end of the film through the film-winding mechanism.

11. A camera substantially as claimed herein with reference to the accompanying drawings.

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Sheet 1

FIG. 1

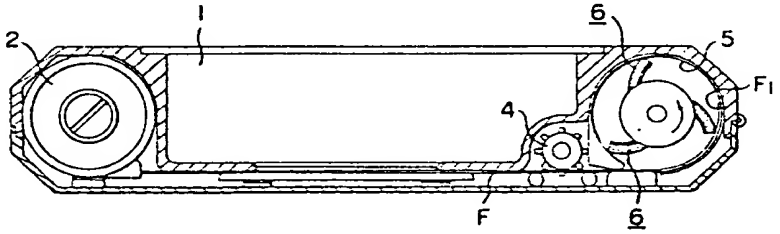


FIG. 2

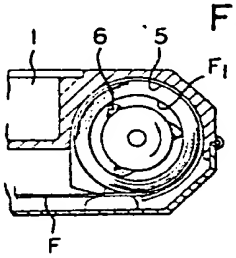


FIG. 3

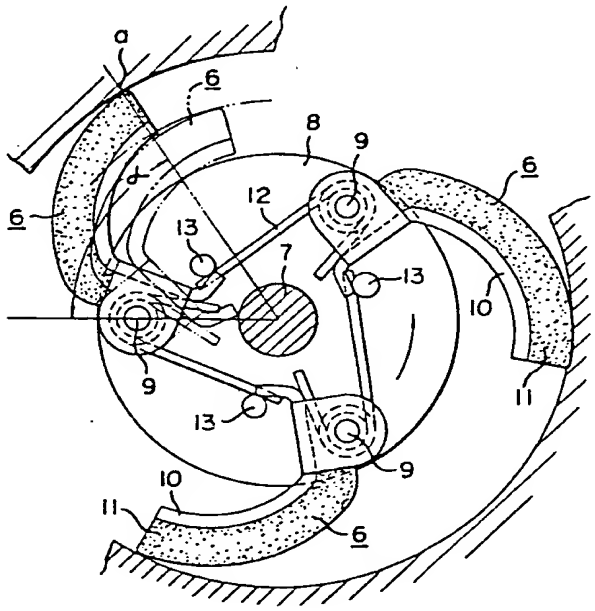

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FIG. 4

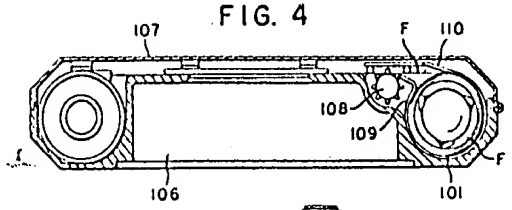


FIG. 5

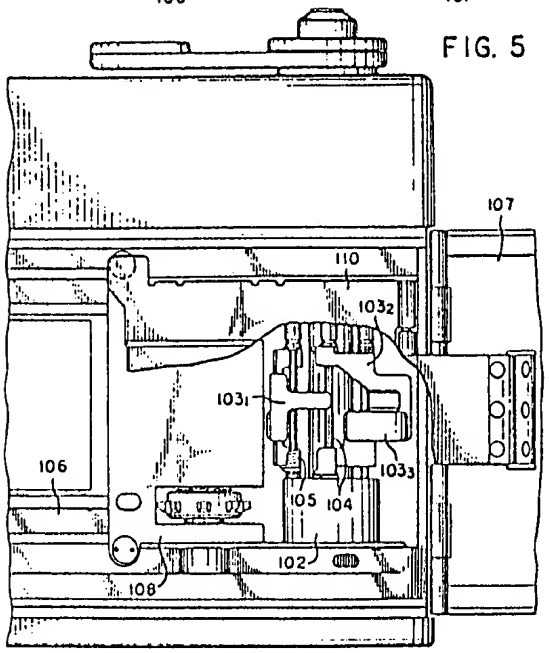


FIG. 6

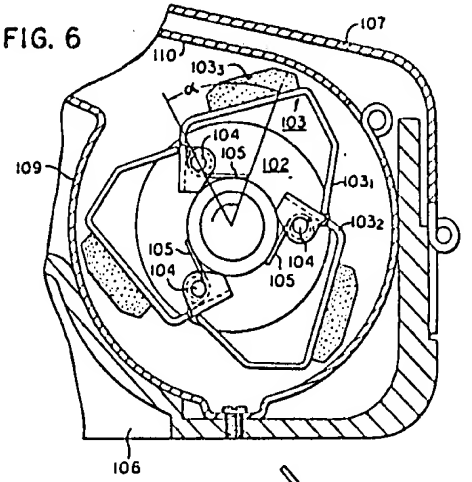


FIG. 8

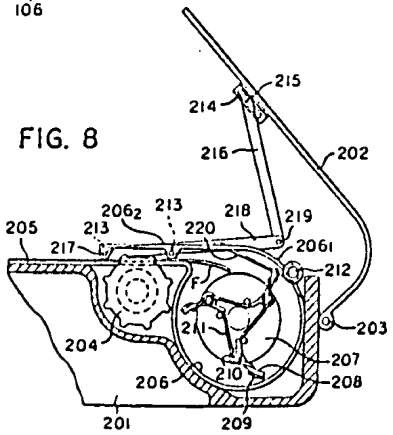

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FIG. 7

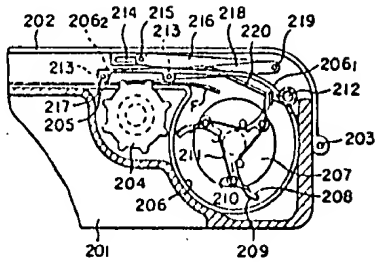



FIG. 9

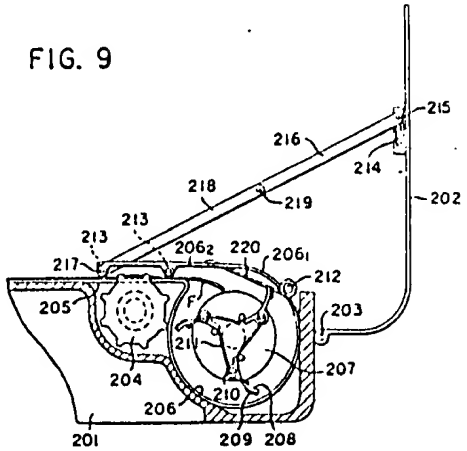
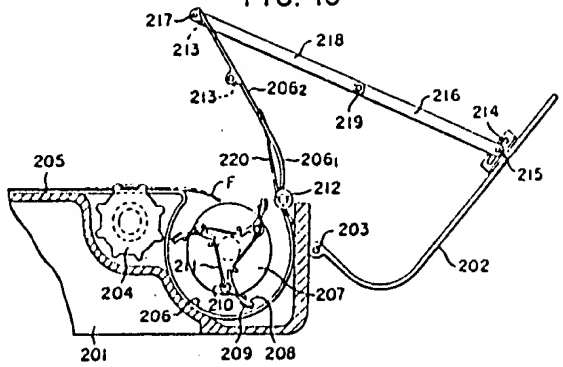



FIG. 10



1103946 COMPLETE SPECIFICATION
11 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheets 6 & 7

FIG. 11

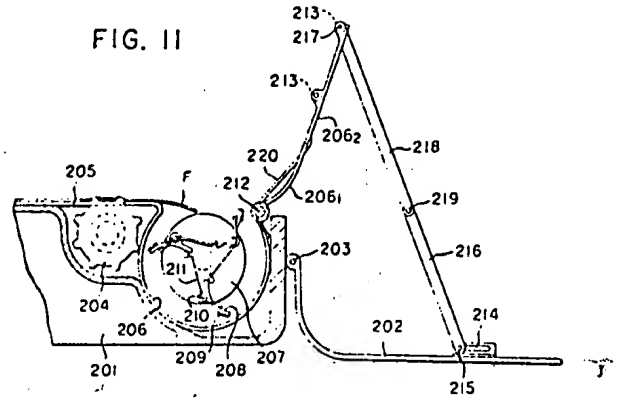



FIG. 13

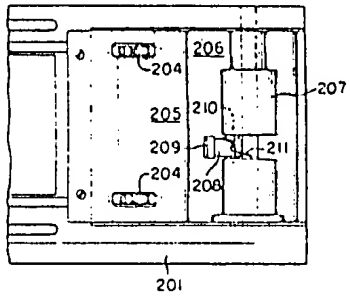



FIG. 12

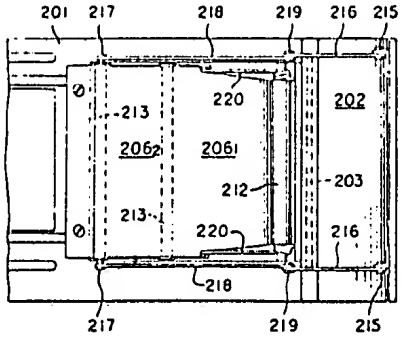
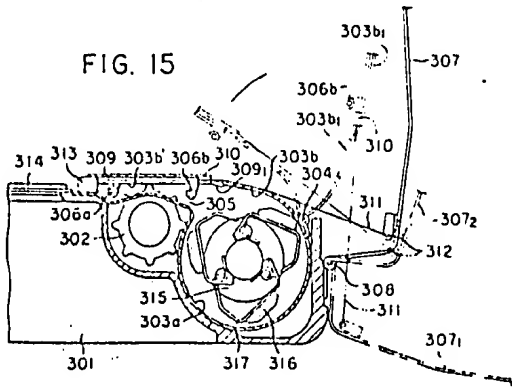



FIG. 15



1100946 COMPLETE SPECIFICATION
11 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheets 8 & 9

FIG. 14

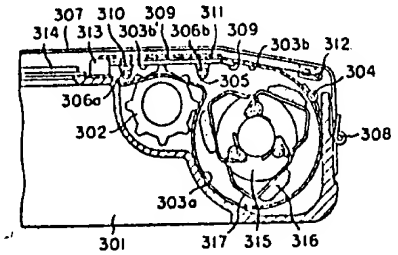
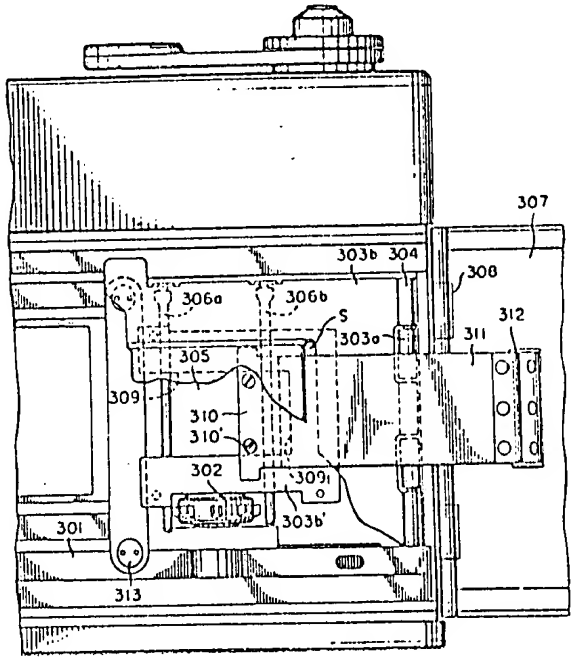



FIG. 16



1103946 COMPLETE SPECIFICATION
11 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 10 & 11

FIG. 17

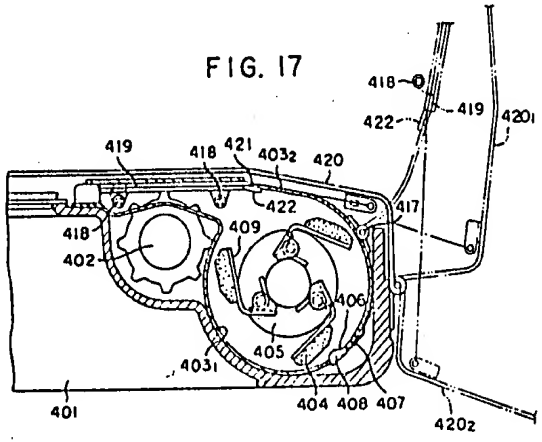



FIG. 18

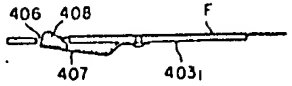



FIG. 19

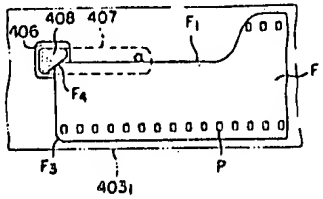



FIG. 20

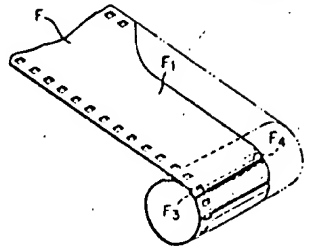



FIG. 21